

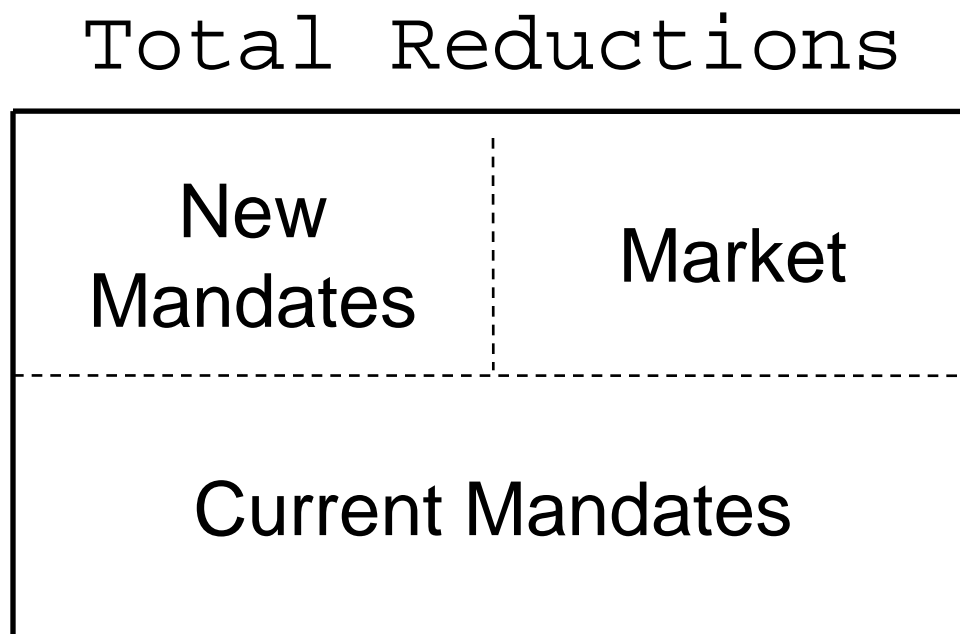
Regulatory Approaches to GHG Reduction in the Energy Sectors



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Generic Representation of Sector Emission Reduction Measures



Energy and Environmental Economics (E3) Modeling

- A combination of production cost dispatch model and a spreadsheet scenario planning tool
- Identifies the *physical cost* of achieving high penetrations of renewables, energy efficiency and other preferred resources
- Analysis based on *current technology and cost* assumptions
- Numbers presented today do not include any assumed cap-and-trade program
- Source of all data presented: E3 draft analysis for CPUC

Assumptions for two primary cases

Measure Category	Existing Policy (also called BAU Reference Case)	Aggressive Policy
Energy Efficiency	Current EE forecast levels (16,450 GWh)	Itron “High-goals” EE scenario (59,126 GWh)
Renewables	20% RPS for all utilities	33% RPS for all utilities
California Solar Initiative (CSI)	847 MW new solar	3,000 MW new solar
Combined Heat and Power (CHP)	No new CHP	1,574 MW small (<5 MW) 2,804 large (>5 MW)

Projected Emissions Reductions

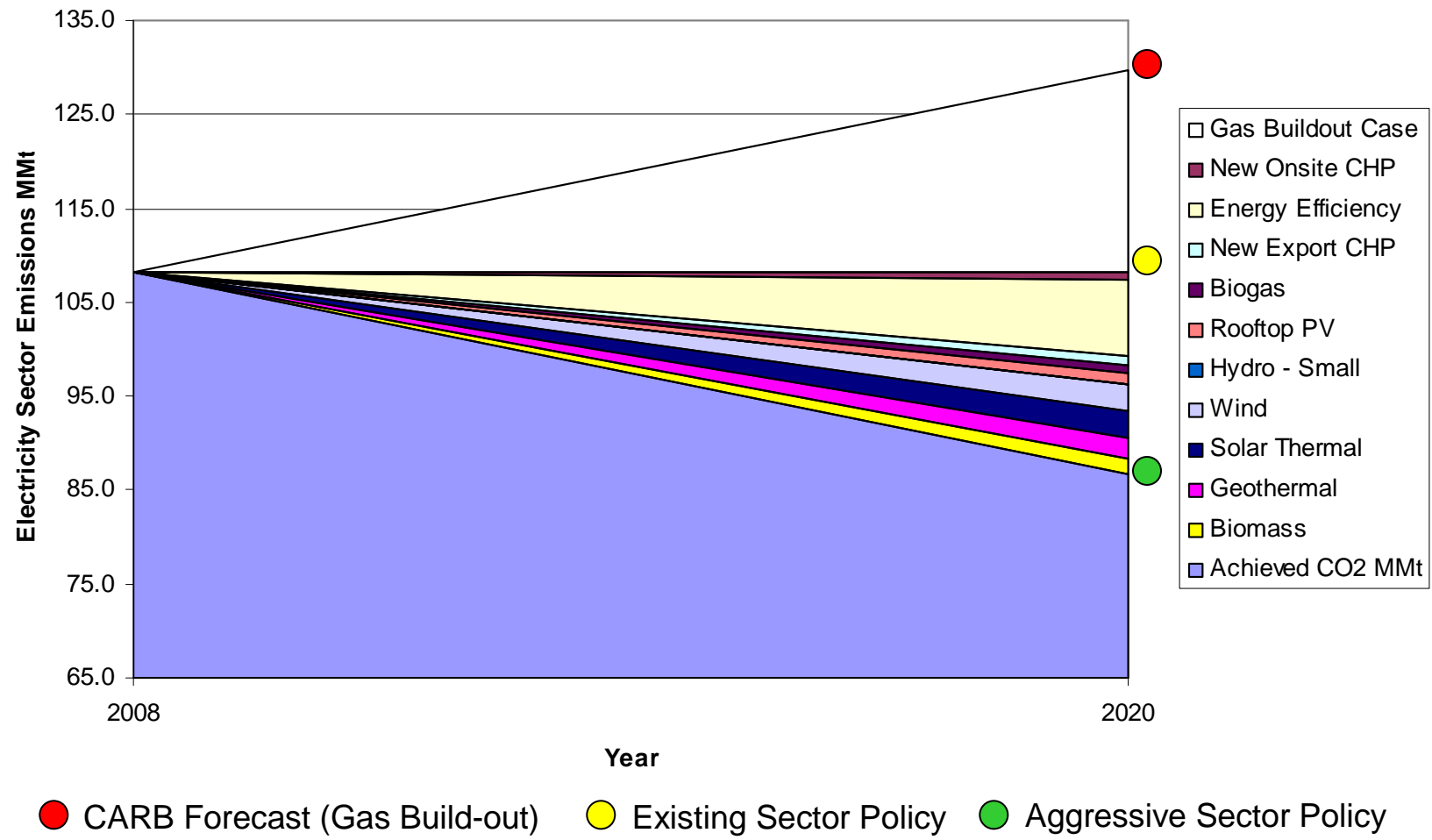
(in million metric tons of CO₂e)

Measure Category	Existing Policy	% of Total	Aggressive Policy	% of Total
EE	6.7	40%	8.0	37%
Renewables	9.9	58%	10.3	44%
CSI	0.4	2%	1.3	6%
CHP	0	0%	1.9	9%
<i>Total</i>	17.0	100%	21.5	100%

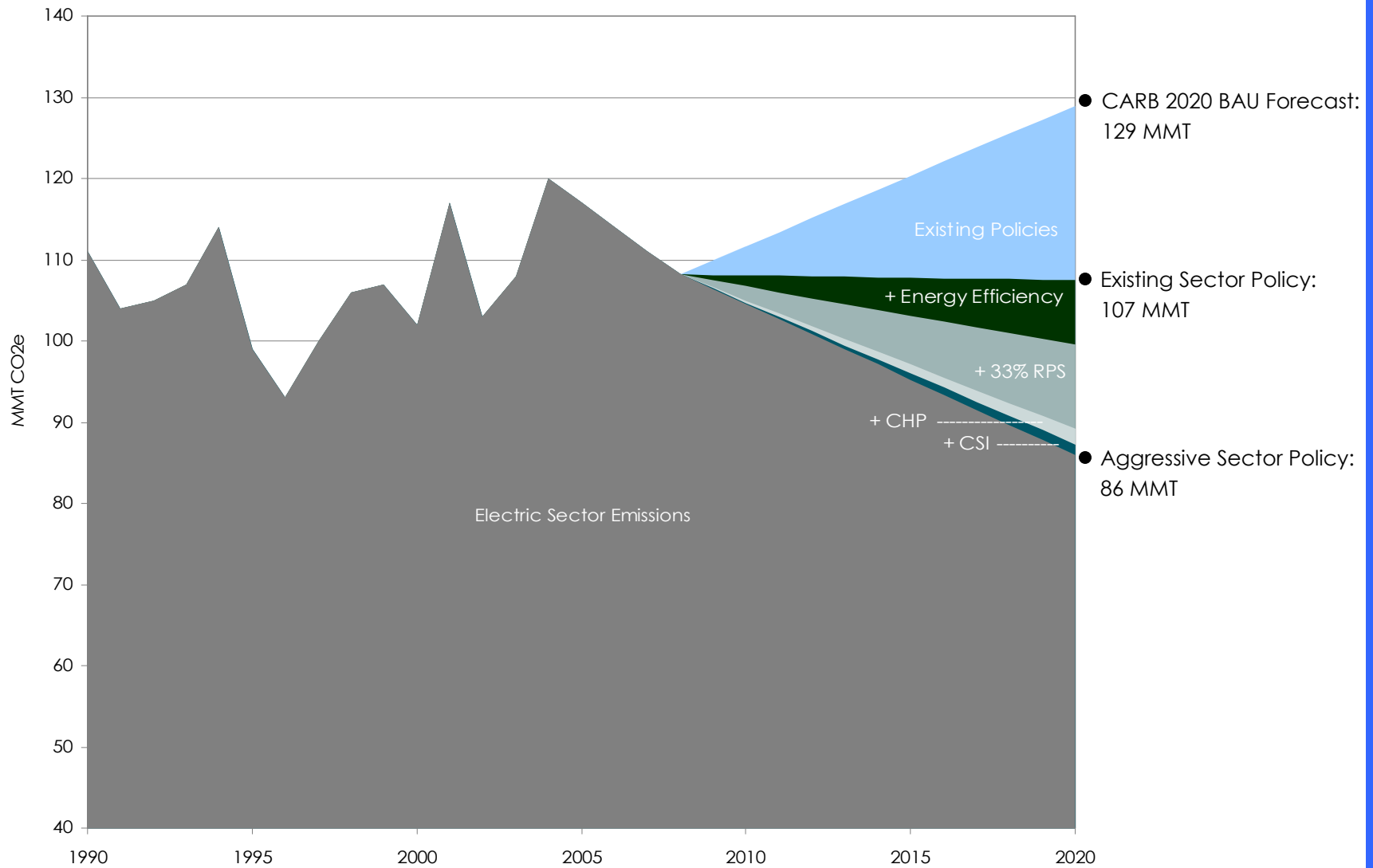
Notes: Analysis is preliminary; cases are additive and compared to a conventional resource build-out scenario.

CO2 Savings, Aggressive Policy

Source of Reductions for California CO2 Reduction

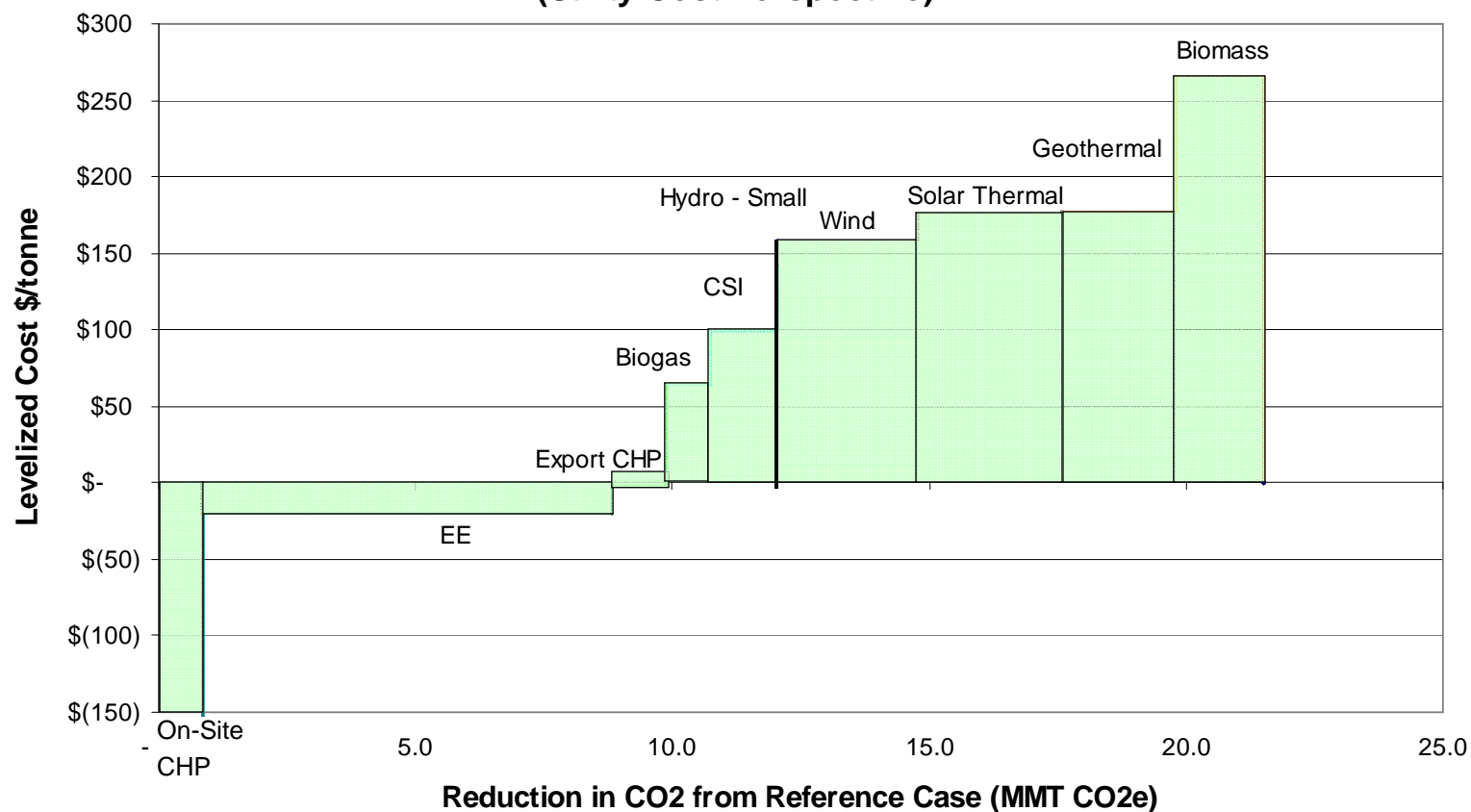


Electric Sector “Wedges” Graph



“Aggressive” Emission Reduction Supply Curve

CO2 Supply Curve of Incremental Low-Carbon Resources to BAU
(Utility Cost Perspective)



Average Cost \$48/tonne

Cost Estimates

(average per ton of CO2 reduced – not marginal)

Measure Category	Existing Policy			Aggressive Policy		
	Utility	Consumer	Total	Utility	Consumer	Total
EE	-\$162	\$52	-\$110	-\$20	\$56	\$36
Renew.	\$27	0	\$27	\$95	\$0	\$95
CSI	\$125	\$1011	\$1136	\$99	\$1,211	\$1,310
CHP	\$0	\$0	\$0	-\$472	\$993	\$521
<i>Weighted Average</i>	-\$7	\$46	\$39	\$48	\$218	\$266

- Huge uncertainty in these estimates, particularly aggressive energy efficiency

Fundamental Questions

- What means should CA employ to achieve the upper end of aggressiveness? Mandates or market?
 - Theory and conventional wisdom suggest market is a more cost-effective means
 - But CA-only market-based program subject to significant leakage vulnerabilities
 - Mandates are immune to leakage threats
 - In the longer term (with broader regional coverage) a market based system may operate more effectively
- Should target for the sector be set based on current assumptions regarding costs and technological potential, or set as a stretch goal?
 - Remember: whole point of market is drive innovation and cost-savings. -- i.e. to prove the conservative assumptions underlying this model wrong

**Questions?
Comments?
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